



GATO/MC2 SPO

GATM REQUIREMENTS TIMELINE

30 Jul 97

Maj Mark
Erickson

GATO/MC2

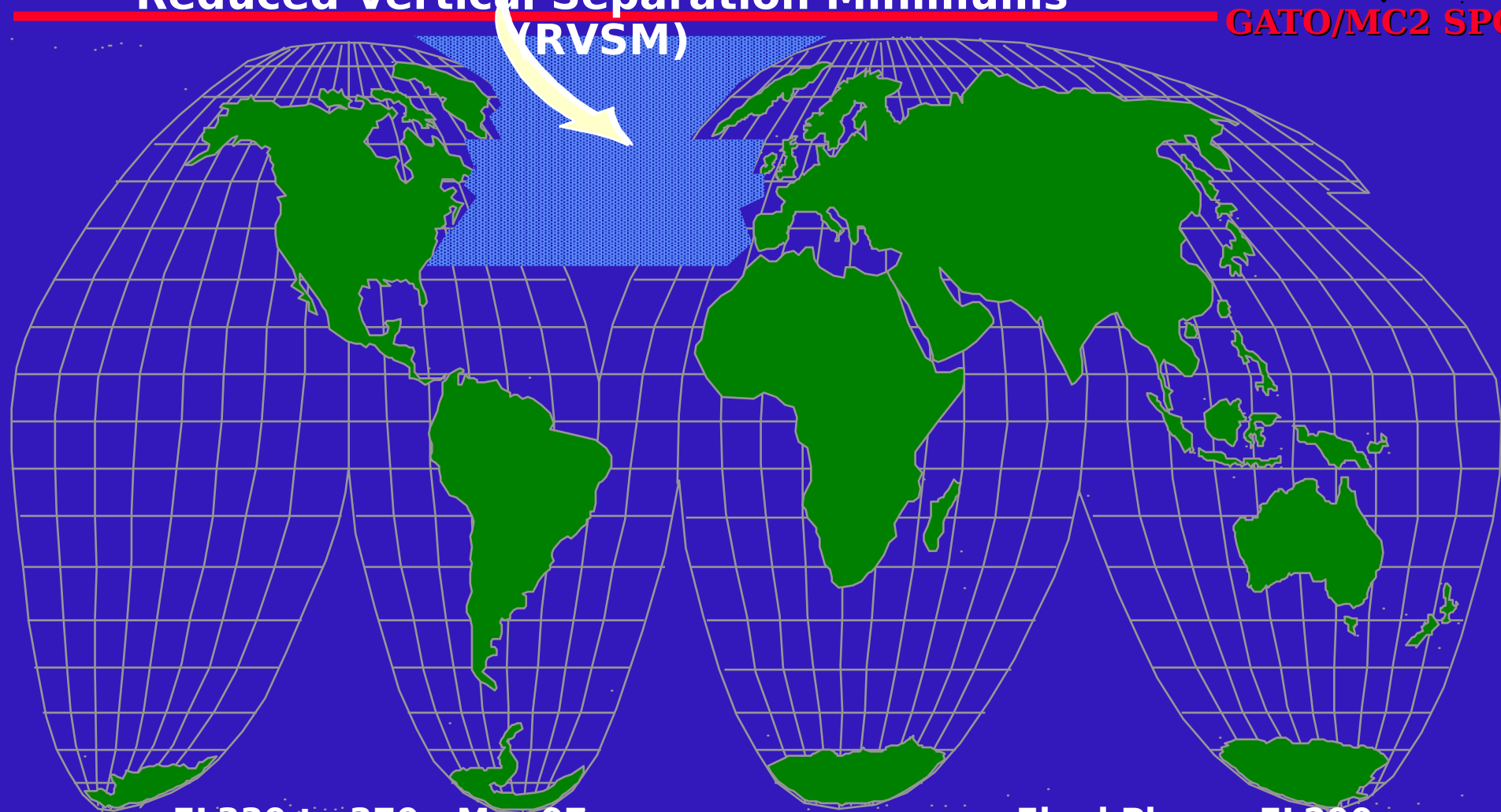
Cadre

Phased Implementation -- 1997



Reduced Vertical Separation Minimums (RVSM)

GATO/MC2 SPC



FL330 to 370 - Mar 97
to 410 - 2000

Final Phase: FL290

Expansion to Additional FLs - Mar 08

Phased Implementation -- 1998

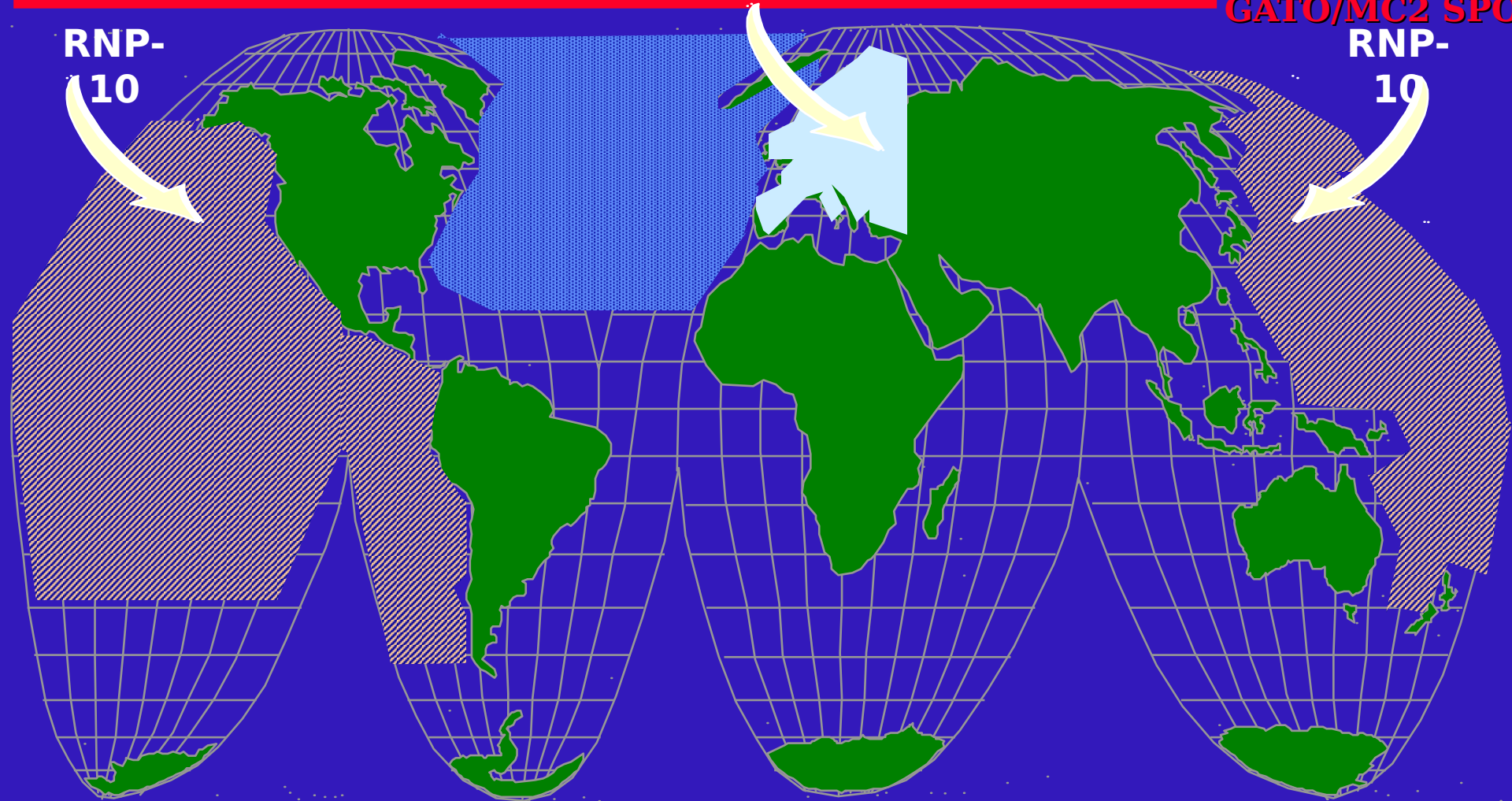
Basic RNAV (RNP-5)



GATO/MC2 SPO

RNP-
10

RNP-
10



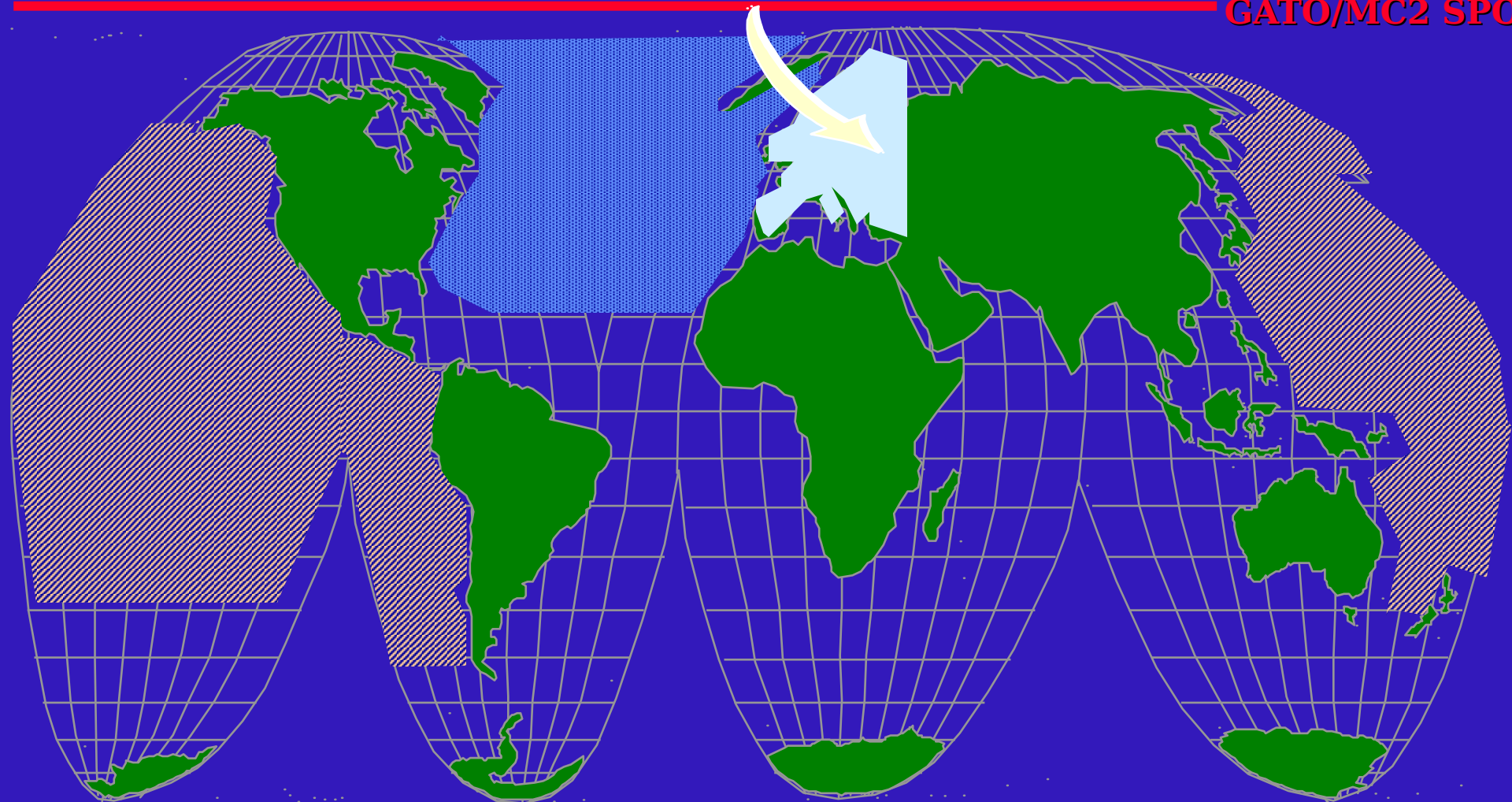
RNP - Required Navigation Performance

Phased Implementation -- 1999

8.33kHz VHF Radio



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Phased Implementation -- 2000

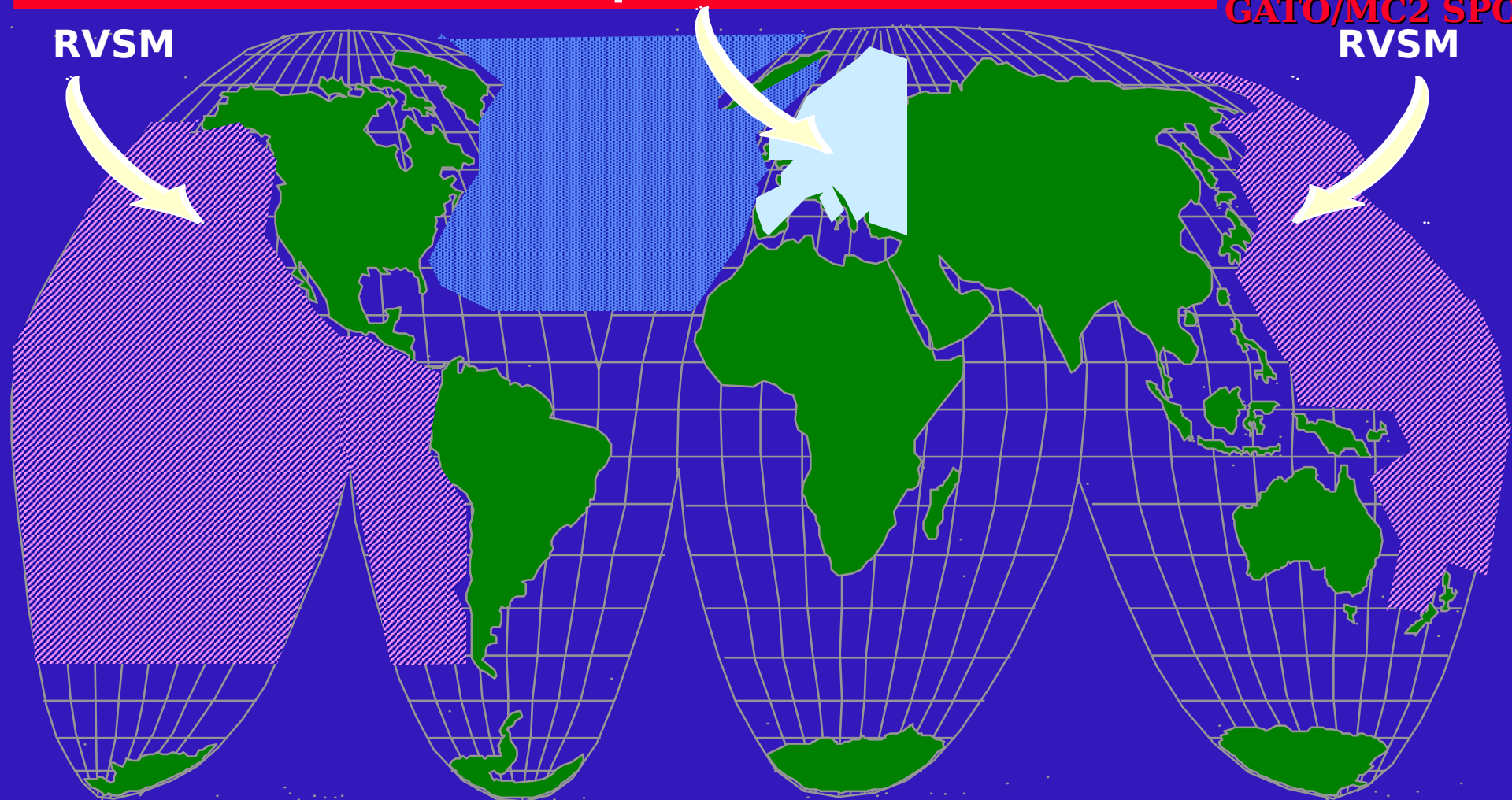


GATO/MC2 SPO
RVSM

TCAS (Passenger Aircraft)
Reduced Vertical Separation Mins (RVSM)

RVSM

RVSM

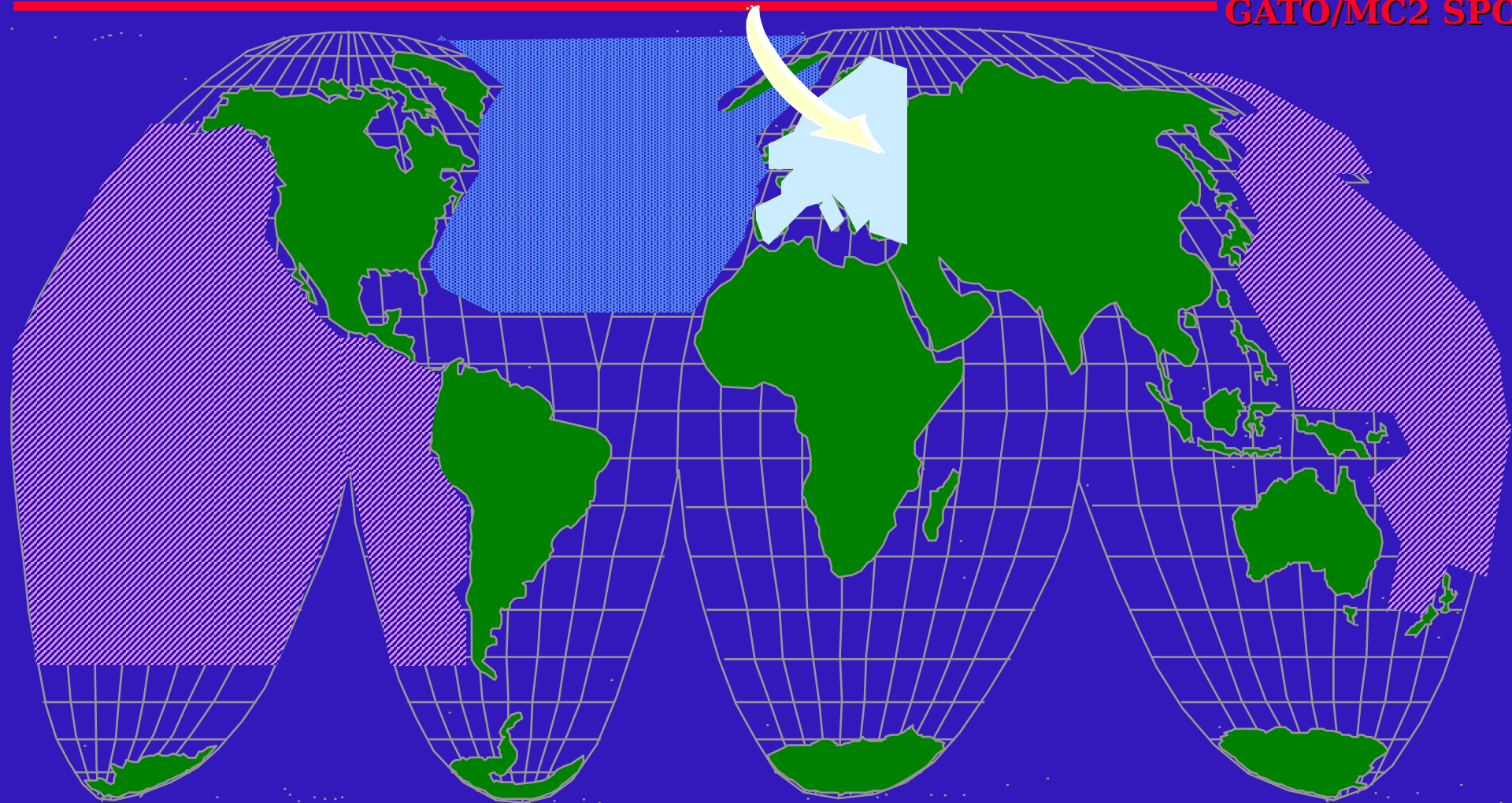


Phased Implementation -- 2001

Protected ILS, Mode S (New Aircraft)



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Phased Implementation -- 2003

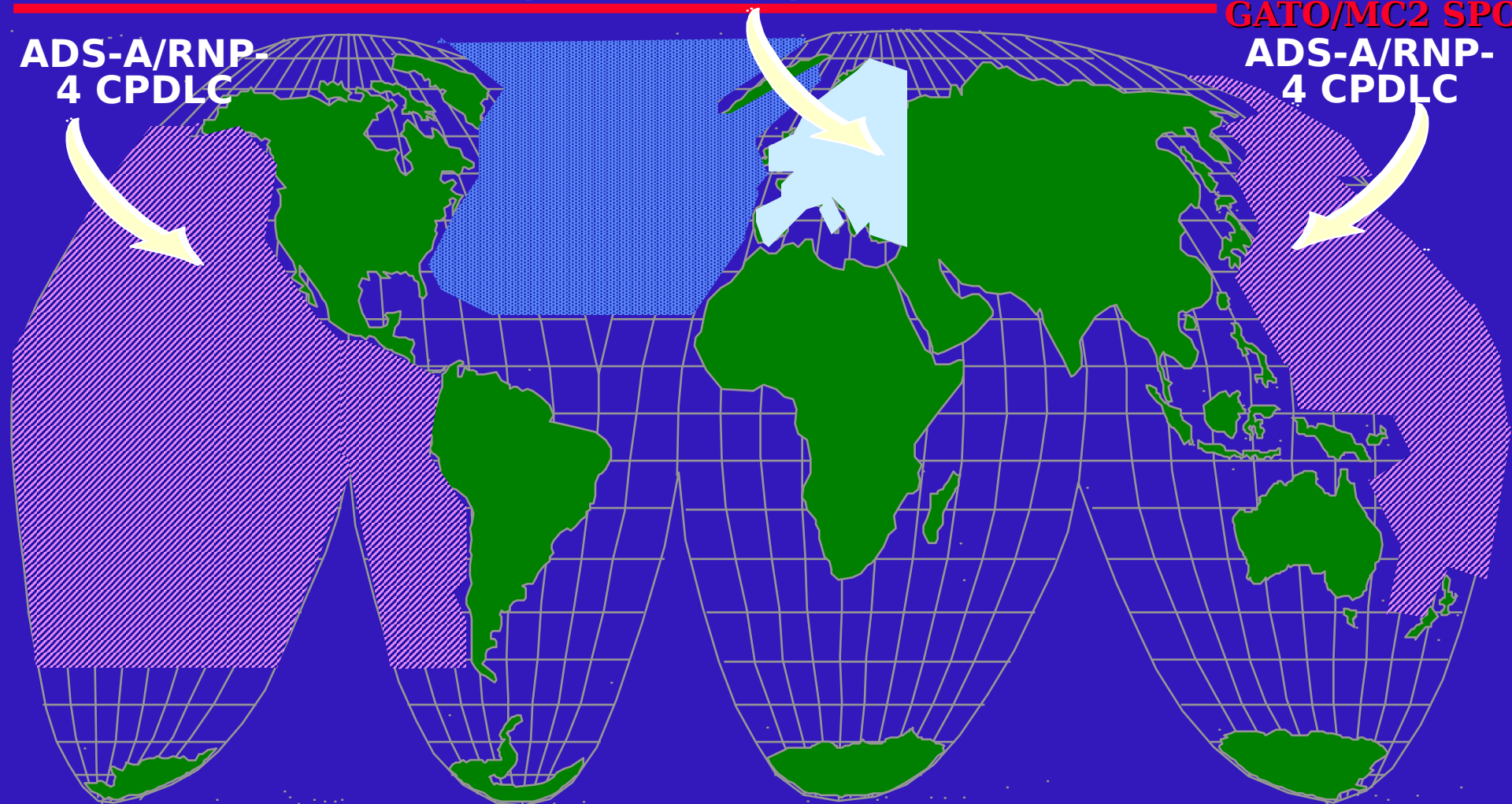
Mode S (All aircraft)



GATO/MC2 SPO

ADS-A/RNP-
4 CPDLC

ADS-A/RNP-
4 CPDLC



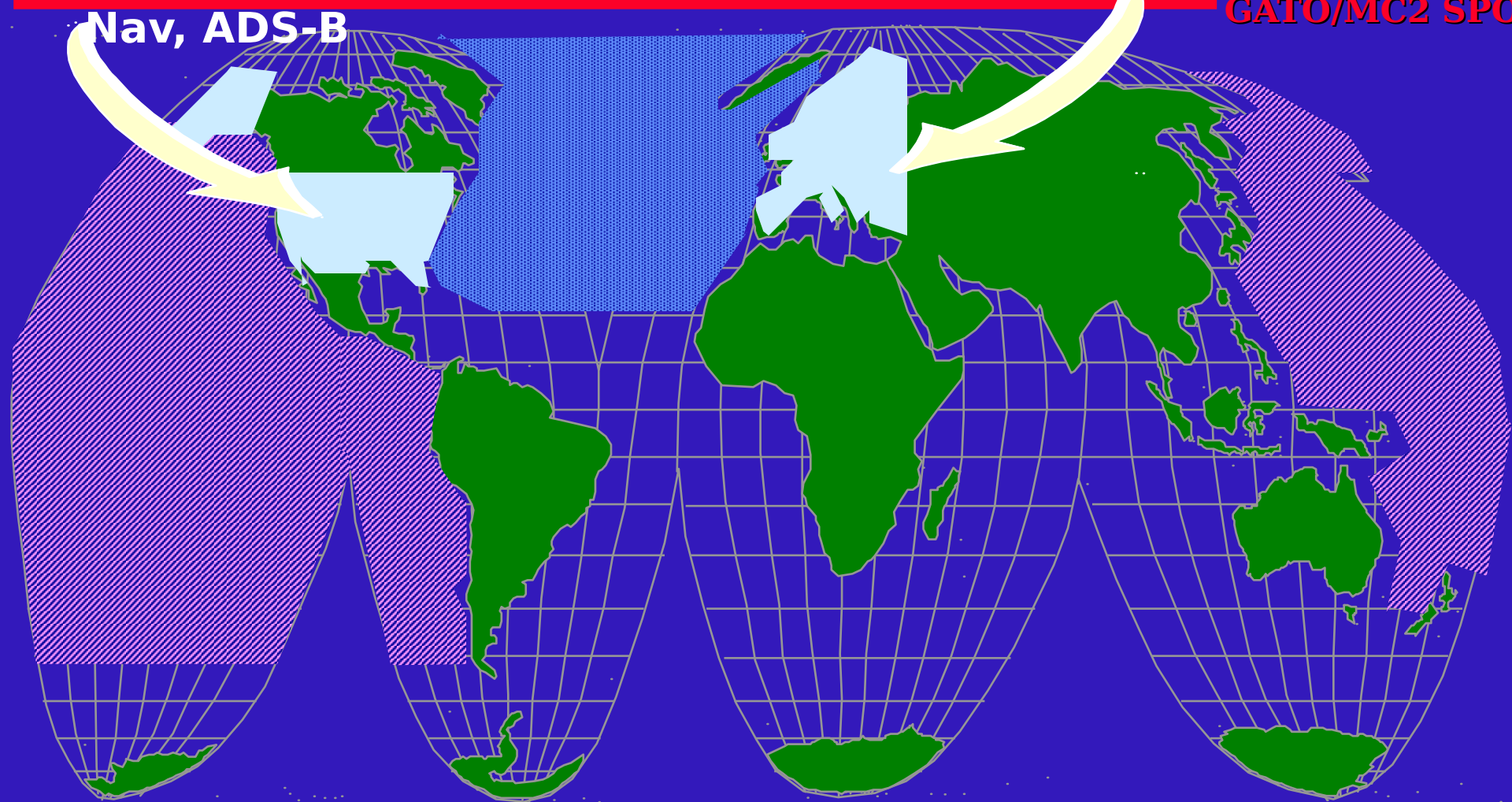
Phased Implementation -- 2005+

Data Link
Comm, GPS
Nav, ADS-B

Data Link
Comm, RNP-1



GATO/MC2 SPO



GANS ANNUNCIATOR PANEL



GATO/MC2 SPO

	GLOBAL REACH							GLOBAL POWER		
AIRSPACE ACCESS CRITERIA	C-5	C-17	C-21	C-130	C-141	KC-10	KC-135	F-15	F-16	A-10
COMMUNICATIONS										
AIR/GROUND DATALINK - DOMESTIC	C									
AIR/GROUND DATALINK - OCEANIC										
VOICE COMM - US										
VOICE COMM - EUROPE										N/A
VOICE COMM - OCEANIC			N/A							N/A
NAVIGATION										
RVSM			N/A							N/A
RNP-10										
RNP-5 (BRNAV)			N/A							N/A
RNP-4										
RNP-1										
PRECISION LANDING										N/A
PROTECTED ILS	N/A									N/A
GPS 2000			N/A							N/A
GPS III/NAVWAR										
SURVEILLANCE										
TCAS									N/A	N/A
MODE-S									N/A	N/A
ADS-A									N/A	N/A
ADS-B									N/A	N/A
SAFETY										
FLT DATA RECORDER								N/A	N/A	N/A
COCKPIT VOICE RECORDER								N/A	N/A	N/A
EMERGENCY LOCATOR TRANS										
WIND SHEAR										
ENHANCED GPWS										N/A

Plus....

Trainin
g

Spec
Ops

Groun
d

N/A No Mission Impact

Long-Term Impact (Not Programmed)

Criterion Met

Near-Term Impact (Not Programmed)

Timing Late, \$\$ Short

Enough \$\$ to meet Schedule

COMMUNICATIONS



GATO/MC2 SPO

- AIR/GROUND DATALINK - DOMESTIC (VHF DATALINK)
- AIR/GROUND DATALINK - OCEANIC (HF DATALINK/SATCOM)
- VOICE COMM - US (25 kHz VHF/TDMA)
- VOICE COMM - EUROPE (8.33 kHz VHF)
- VOICE COMM - OCEANIC (SATCOM)

AIR/GROUND DATALINK- DOMESTIC (VHF DL)



GATO/MC2 SPOC

- CAPABILITY REQUIRED:
 - Fulfills ATC/Flight Service/Surveillance Functions
 - Message Set for Clearances, Waypoints, Flight Plans
 - Standard ATC Datalink in US TBD (Current plan calls for VHF TDMA)
 - Standard ATC Datalink in Europe TBD
- AIRSPACE APPLICABILITY:
 - CONUS Mode 3 (TDMA): 2004 - 2010 (Low Confidence)
 - Europe Mode 2 (CSMA): 2005 (Low Confidence)
- DOCUMENTATION: Draft SARPS Available
 - TDMA: Draft MASPS Available
 - Mode 2: ARINC 750, Draft MOPS Available
- POSSIBLE SOLUTION(S): Mode 2 Commercial Radios Available Now. Various Commercial & Military VHF Radio Upgrades
- IMPACT OF NON-COMPLIANCE: Denial of ATC Services, Handling Delays, Ultimately Exclusion From Affected Airspace

AIR/GROUND DATALINK - OCEANIC (HF DL/SATCOM)



GATO/MC2 SPO

- CAPABILITY REQUIRED:
 - Fulfills ATC/Flight Service/Surveillance Functions (Oceanic)
 - Message Set for Clearances, Waypoints, Flight Plans
 - Two Different/Independent Datalink Systems Eventually Required
- AIRSPACE APPLICABILITY:
 - Pacific 2003-2005 (Medium - High Confidence)
 - NAT >2000 (Low - Medium Confidence)
- DOCUMENTATION:
 - HF DL: Draft SARPS, MASPS, MOPS Late 97, ARINC 753, 635, 634
 - SATCOM: AMSS SARPS, Annex 10; ARINC 741; RTCA DO-210C,215A,222; ICAO Annex 11 Proposal
- POSSIBLE SOLUTION(S): ARC-190/CP2024B With HF DL Upgrade (Needs CMU Implementation), SATCOM - Inmarsat (Aero-H/I), Iridium(?)
- IMPACT OF NON-COMPLIANCE: Excluded From Affected Airspace

VOICE COMM - US (25 kHz VHF/TDMA)



GATO/MC2 SPO

- CAPABILITY REQUIRED:
 - US Will Retain Existing 25 kHz VHF System As Europe Goes to 8.33 kHz
 - FAA Has Ongoing "Next Generation VHF Communications" Program
 - TDMA Is Currently Favored, Provides Integrated Voice and Data Capability
- AIRSPACE APPLICABILITY:
 - CONUS TDMA 2004 - 2010 (Low Confidence)
- DOCUMENTATION:
 - Draft SARPS and MASPS Available
- POSSIBLE SOLUTIONS: Various Commercial & Military VHF Radio Upgrades
- IMPACT OF NON-COMPLIANCE: Denial of some ATC services, Handling Delays

VOICE COMM - EUROPE (8.33 kHz VHF)



GATO/MC2 SPO

- CAPABILITY REQUIRED:
 - Capable Of 8.33 kHz VHF Operation To Alleviate Frequency Congestion
 - Compatibility With Existing 25 kHz US System
- AIRSPACE APPLICABILITY:
 - Beginning 1 Jan 99 in Europe (High Confidence)
 - Implemented Above FL195 in France and FL 245 in Austria, Belgium, Netherlands, Germany, Luxembourg, Switzerland, and United Kingdom
- DOCUMENTATION: Final Carriage Documents Available
 - Eurocontrol 8.33 Implementation Plan, 8.33 kHz User Guide, AIC IFR 6/96 (Ger)
- POSSIBLE SOLUTIONS: Various Mil/COTS VHF-Capable Radios
- IMPACT OF NON-COMPLIANCE: Excluded From Affected Airspace, Unless UHF Workaround Available. Handling/Dispatch Delays Possible With UHF Workaround.

VOICE COMM - OCEANIC (SATCOM)



GATO/MC2 SPO

- CAPABILITY REQUIRED:
 - Largest Issue Is Whether BLOS Voice Is Required As Backup to Datalink
 - ICAO Annex 11 Proposal Requires Direct Controller/Pilot Voice Communication for RNP-4/5 Procedural Environment
- AIRSPACE APPLICABILITY:
 - Pacific 2003-2005 (Medium - High Confidence)
 - NAT >2000 (Low - Medium Confidence)
- DOCUMENTATION: AMSS SARPS, Annex 10; ARINC 741; RTCA DO-210C,215A,222; FAA Notice N8110.58; ICAO Annex 11 Proposal
- POSSIBLE SOLUTION(S):
 - Aero-H/I
 - Iridium (?)
- IMPACT OF NON-COMPLIANCE: TBD

NAVIGATION



GATO/MC2 SPO

- RVSM
- RNP-10
- RNP-5 (BRNAV)
- RNP-4
- RNP-1
- PRECISION LANDING
- PROTECTED ILS

RVSM



GATO/MC2 SPO

- CAPABILITY REQUIRED: 1000 Ft Vertical Separation - FL290-410
 - Requires Two Independent Altitude Measuring Systems, One Altitude Reporting Transponder, Altitude Alert System, Automatic Altitude Control System (Autopilot)
- AIRSPACE APPLICABILITY:
 - NAT FL 330-370 - Mar 97
 - NAT FL 290-410 - 2000 (Medium Confidence)
 - Pacific - 2000 (High Confidence)
 - Europe - 2000 (Medium - High Confidence)
 - CONUS 2001 (Low - Medium Confidence)
- DOCUMENTATION: Final Carriage Documents Available
 - FAA AIC 80/9096 (Yellow 226), FAR Part 91
- POSSIBLE SOLUTION(S): New ADC, New Plumbing, Skin Shimming, New Autopilot
- IMPACT OF NON-COMPLIANCE: Excluded From Affected Airspace, Less Optimum Profiles

RNP-10



GATO/MC2 SPO

- CAPABILITY REQUIRED:
 - Requires Aircraft Be Within 10 NM of Its Cleared Position (Centerline) 95% of Time, Containment Integrity & Continuity
- AIRSPACE APPLICABILITY:
 - Northern Pacific (NOPAC) Routes Apr 98 (High Confidence)
 - Hawaiian (CEPAC) Routes Apr 98 (High Confidence)
 - PACOTS Routes Oct 98 (High Confidence)
 - All Pacific 2000 (High Confidence)
- DOCUMENTATION: Final Technical Documents and Draft Carriage Documents
 - FAA Notice 8110.60, FAA Order 8400.12, FAA Draft NOTAMs
- POSSIBLE SOLUTION(S):
 - Recertify Actual INS/Navigator Performance, GPS With RAIM & FDE
- IMPACT OF NON-COMPLIANCE: Excluded From Affected Airspace

RNP-5 (BRNAV)



GATO/MC2 SPO

- CAPABILITY REQUIRED:
 - Requires Aircraft Be Within 5 NM of Its Cleared Position (Centerline) 95% of Time, Containment Integrity, Continuity, Availability
 - FMS Functionality Required
- AIRSPACE APPLICABILITY:
 - Phased Implementation in Europe, Beginning Within Enroute and Terminal Airspace 29 Jan 1998 (High Confidence)
- DOCUMENTATION: Final Carriage Documents
 - German AIC IFR 5/96, Eurocontrol Std Doc 003-93
- POSSIBLE SOLUTION(S): Potential Mods To Msn Comp; Integrated Nav Sensors into FMS
- IMPACT OF NON-COMPLIANCE:
 - Impact on Controller Handling Capacity, Leading to Non-Optimum Handling

RNP-4



GATO/MC2 SPO

- CAPABILITY REQUIRED:
 - Requires Aircraft Be Within 4 NM of Its Cleared Position (Centerline) 95% of Time, Containment Integrity, Continuity, Availability
 - FMS Functionality Required
- AIRSPACE APPLICABILITY:
 - Pacific - 2003 (Medium - High Confidence)
 - NAT >2000 (Low Confidence)
- DOCUMENTATION: Final Technical Documents
 - MASPS (DO-236), TSO-C129A/8110.60, Boeing RNP for FANS 1
- POSSIBLE SOLUTION(S):
 - S/W Mods To Existing Msn Computers/FMS
 - New COTS FMS
 - Integrated GPS with RAIM, FDE
- IMPACT OF NON-COMPLIANCE: Excluded From Affected Airspace

RNP-1



GATO/MC2 SPO

- CAPABILITY REQUIRED:
 - Requires Aircraft Be Within 1 NM of Its Cleared Position (Centerline) 95% of Time, Containment Integrity & Continuity
 - FMS Functionality Required
- AIRSPACE APPLICABILITY:
 - Europe 2005 (Low-Medium Confidence)
- DOCUMENTATION: Final Technical Documents
 - MASPS, DO-236
- POSSIBLE SOLUTION(S):
 - S/W Mods To Existing Msn Computers/FMS
 - New COTS FMS
 - Integrated Nav Sensors
- IMPACT OF NON-COMPLIANCE: Excluded From Affected Airspace

PRECISION LANDING



GATO/MC2 SPO

- CAPABILITY REQUIRED:
 - FAA Aggressively Pursuing GPS-Based Precision Landing Technologies
 - Wide-Area Augmentation System (WAAS) for Near-CAT I
 - Local Area Augmentation Systems (LAAS) for CAT II/III Operations
 - Europe pursuing MLS at least for CAT III
- AIRSPACE APPLICABILITY:
 - CONUS WAAS - 2001 (Low - Medium Confidence)
 - LAAS >2001 (Low - Medium Confidence)
- DOCUMENTATION: Final Technical Documents
 - MASPS, RTCA DO-217, MOPS, DO-229 (WAAS)
- POSSIBLE SOLUTION(S): PLSR (CAT I), JPALS (CAT I), GPS III UE (?)
- IMPACT OF NON-COMPLIANCE: Handling delays, inability to land at some airports under some conditions

PROTECTED ILS



GATO/MC2 SPO

- CAPABILITY REQUIRED:
 - ILS Receivers in Europe Must Meet New Interference Requirements Due to Interference From High-Power FM Radio Stations
 - Current DOD Receivers Do Not Meet Standards
- AIRSPACE APPLICABILITY:
 - Europe - 2001 (High Confidence)
- DOCUMENTATION: Final Carriage Documents
 - UK CAA Airworthiness Notice No. 84, Ger Nfl II 68/94, Ger Nfl 75/96
- POSSIBLE SOLUTION(S):
 - Workarounds Until 1 Jan 01, PLSR, Mod Kit ARN 147/108, COTS ILS Box
- IMPACT OF NON-COMPLIANCE: Handling delays

SURVEILLANCE



GATO/MC2 SPO

- TCAS
- MODE-S
- ADS-A
- ADS-B

TCAS



GATO/MC2 SPO

- CAPABILITY REQUIRED:
 - Requires TCAS System, Mode S Transponder, Stand-Alone Display or EFIS
 - Monitors Other Aircraft in Vicinity by Interrogating Airborne Transponders and Assesses Collision Risk
 - Provides Vertical Avoidance Maneuver Advice
- AIRSPACE APPLICABILITY:
 - Europe in 2000 - 15000+Kg and/or 30+ Seats (High Confidence)
 - Europe in 2005 - 5700+Kg and/or 19+ Seats (High Confidence)
- DOCUMENTATION: Final Carriage Documents
 - Eurocontrol Specimen AIC, Late 96; Swed AIC 8/1996
- POSSIBLE SOLUTION(S): COTS TCAS Systems
- IMPACT OF NON-COMPLIANCE: TBD

MODE-S



GATO/MC2 SPO

- CAPABILITY REQUIRED:
 - Transponder That Provides Digital Air/Ground and Air/Air Datalink
 - Improved Accuracy and Altitude Resolution
 - Reduction in Interference From Closely Spaced Aircraft
- AIRSPACE APPLICABILITY: Europe - Level 2/DAP
 - New Aircraft - 2001 (High Confidence)
 - All Aircraft - 2003 (High Confidence)
- DOCUMENTATION: Final Carriage Documents
 - ICAO Doc 7030; Ger AIC 13/92; Eurocontrol Specimen AIC, Late 96
- POSSIBLE SOLUTION(S):
 - APX-100, RT1717, MOTS Mode S, COTS Mode S (?)
- IMPACT OF NON-COMPLIANCE: ATC Handling Delays

ADS-A



GATO/MC2 SPO

- CAPABILITY REQUIRED:
 - Automatically Transmit 4-D Position and Flt Plan Intent Information
 - GPS-Derived Position and BLOS Datalink
 - Function of FMS Through Comm Mgt Unit (CMU)
 - Requires Message Alerting/Annunciation
- AIRSPACE APPLICABILITY:
 - Pacific 2003 (Medium - High Confidence)
 - NAT >2000 (Low Confidence)
- DOCUMENTATION: Final Technical, Draft Carriage Documents
 - Boeing ATS SR&O, ICAO Manual of ATS DL Applications, MOPS, DO-212, ARINC Char 745, 622-2
- POSSIBLE SOLUTION(S): Host In FMS or CMU
- IMPACT OF NON-COMPLIANCE: Exclusion from Affected Airspace

ADS-B



GATO/MC2 SPO

- CAPABILITY REQUIRED:
 - Automatically Transmit 4-D Position and Flt Plan Intent Information
 - GPS-Derived Position and LOS Datalink
 - Function of FMS Through Comm Mgt Unit (CMU)
 - Mode-S Transponder (US GPS Squitter Approach) or Digital VHF Radio (European S-TDMA approach)
 - Requires Cockpit Display of Traffic Information (CDTI)
- AIRSPACE APPLICABILITY:
 - CONUS 2008-2012 (Medium Confidence)
- DOCUMENTATION: Draft Technical Documents
 - ARINC Char 718, Supp 5; SC-186, MASPS
- POSSIBLE SOLUTION(S): Host In FMS/CMU
- IMPACT OF NON-COMPLIANCE: TBD